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The impact of extreme earthquake occurrences in the estimation of seismic hazard: the Mexico City case

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The consequences of the occurrence of recent large earthquakes worldwide such as the 1985 in Mexico, the 1985 in Chile, the 1988 in Armenia, the 1989 and 1994 in California, USA, the 1995 in Kobe, Japan, those of 1999 in Turkey and Taiwan, and that of 2003 in Bam Iran, stress the importance of performing seismic hazard studies that reflect not only the uncertainties related to the occurrence and location, but specially on the (extreme) very large magnitudes expected earthquakes. The incidence of extreme magnitude earthquakes, on the particular characteristics of the expected strong ground motions (i.e. amplitudes, frequency content, duration) at a specific site on a given seismic region, has already been shown on the recordings and the destructive effects of the above mentioned earthquakes.

In this work we present the main features of the methodologies developed since the early 80´s, to estimate the seismic hazard in Mexico City taking into account the possibility of occurrence of large events, as well as to generate strong ground motion synthetics associated to the estimated hazard. The methodologies to estimate the seismic hazard are based on Bayesian statistics and the Monte Carlo simulation technique, this in order to obtain the probability of exceedance of the strong ground motion parameters of interest. The generation of the strong motion synthetics is achieved by a hybrid method which allows the generation of broadband synthetics expected in Mexico City compressive soils.

The analysis of the results obtained by the application of those methodologies to estimate the seismic hazard for Mexico City compressive soils sites, before and after the

1985 Ms 8.1 Michoacan earthquake is thoroughly discussed. Finally, we address the importance of making seismic hazard statements, based on the tails of the probability distributions of the strong ground motion parameters. This instead of the expected values, or the expected values plus one standard deviation, on which many hazard studies are based, particularly if we are aiming to incorporate the occurrence of extremely large earthquakes.